

U.S. FIELD CROP AGRICULTURE:  
IS IT LOSING COMPARATIVE ADVANTAGE?

by

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## ABSTRACT

Appreciation of the U.S. dollar implies that U.S. competitiveness in world agricultural markets hinges increasingly on the U.S.'s advantage in physical production efficiency. Yet, for five of the six largest U.S. field crops exported, the ratio of U.S. yields to yields for the rest of the world excluding the U.S. has declined since 1965. Thus, much of U.S. field crop agriculture may be losing some of its advantage in physical production efficiency, raising questions about whether it can "export itself" to prosperity even if demand conditions of the 1970s return.

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From the mid-1930s through the mid-1960s, U.S. crop agriculture enjoyed an unprecedented growth in productivity. By the mid-to-late 1970s, however, observations of a declining rate of increase in agricultural productivity, in particular the rate of increase in the yields of major field crops, suggested that future U.S. food production might fall short of future domestic and export demand. (1,2,3) While shortages have not materialized, indeed surpluses have reappeared, the decline in the rate of growth of U.S. crop productivity has potential, long-term ramifications; it may signal erosion of the U.S.'s generally acknowledged comparative advantage in the production of major temperate field crops.

To examine whether U.S. field crop agriculture is losing comparative advantage, changes in the cost of producing all commodities in the U.S., including U.S. field crops, would have to be calculated. These changes would then have to be compared with changes in the exchange rate adjusted cost of producing all commodities, including U.S. field crops, in the rest of the world. In addition, changes in the cost of transporting commodities between countries would have to be examined.

The increasing value of the dollar since 1980 has lowered the exchange rate adjusted cost of producing commodities in other countries and thus eroded U.S. comparative advantage. Furthermore, legislation which would require that part of U.S.

exports be shipped on higher cost U.S. ships continues to surface on the national agenda. (4) These two events imply that comparative advantage of U.S. agriculture in terms of the cost of production before exchange rate adjustments (hereafter referred to as domestic cost of production) has become and may continue to become increasingly important for the export competitiveness of U.S. agriculture.

Analysis of relative changes in the domestic cost of producing agricultural commodities is constrained by a lack of cost of production data for most countries. Therefore, an analysis of changes in the domestic cost of production is reduced to using changes in physical production efficiency as a proxy. The only physical production efficiency measure available for most countries is crop yield. Since yield measures productivity on only one factor, land, it is obviously an imperfect proxy for overall physical production efficiency let alone domestic cost of production. Nevertheless, changes in U.S. crop yields relative to crop yields in the rest of the world excluding the U.S. may identify relative changes in the domestic cost of production.

The stage is set for analyzing relative changes in U.S. and non-U.S. world yields of major U.S. field crops by examining the rate of growth of yield for ten U.S. field crops between 1948 and 1982: wheat, rice, corn, barley, oats, sorghum, soybeans, peanuts, cotton, and tobacco. Changes in the ratio of U.S. to non-U.S. world yields of these ten crops over the same period are then examined.

## GROWTH RATE OF MAJOR U.S. FIELD CROP YIELDS, 1948-1982

Table 1 presents compound annual rates of growth in the yields of the ten crops during three periods: 1950-1965, a period of rapid growth in yields fueled by genetically improved seeds and increased fertilizer use; 1965-1975, a period when concern over declining growth in yields materialized; and 1975-1980, a more recent period. Among the reasons postulated for the slowdown in rate of growth during the 1965-75 period were increasing constraints placed on the use of farm production resources (5); soil erosion and air pollution (5); declining public support for research and extension (5,6); and the return of less productive land production during the early 1970s (7).

Compound annual rates of growth were calculated between five-year average yields centered on the beginning and ending dates of the three periods. For example, for the 1950-65 period, rate of growth was computed between the average yield during 1948-52 and during 1963-67. A five-year average was used to smooth year-to-year fluctuations, thereby revealing longer-term changes.

Reflecting the well-documented decline in rate of growth of aggregate yield during the early-to-mid 1970s, rate of growth in yield for most of the ten crops declined between the 1950-65 and 1965-75 periods. The decline was especially large for sorghum and three of the four crops associated with the southern U.S.: cotton, rice, and tobacco. Rates of growth increased only for peanuts and soybeans.

Table 1. Compound Annual Rates of Growth in Yields of Selected Major Field Crops, U.S., Selected Periods 1948-1982.

Crop	P E R I O D <sup>a</sup>		
	1950-1965	1965-1975	1975-1980
- - - Percent - - -			
<u>Midwestern/Plain States</u>			
Corn	4.0	1.8	4.1
Barley	2.6	0.8	4.2
Oats	2.0	0.5	2.0
Sorghum	6.2	0.6	2.1
Soybeans	0.9	1.2	1.8
Wheat	2.8	1.6	2.4
<u>Southern States</u>			
Cotton	3.9	-0.4	0.9
Peanuts	4.4	4.4	-0.1
Rice	4.2	0.5	0.6
Tobacco	3.1	0.1	0.2

<sup>a</sup>Growth rates computed between five-year average yields centered on beginning and ending years of each period.

Source: Computed from data in U.S. Department of Agriculture, Agricultural Statistics: 1972 and 1983 and U.S. Department of Agriculture, Statistical Reporting Service, "Field Crops: Final Estimates by States, 1978-82, Preliminary 1983."

During the most recent period, 1975-80, rates of growth increased for crops associated with midwestern and plain-state agriculture. In fact, the rates generally matched those of the 1950-65 period. On the other hand, for the crops associated with the southern U.S. only the rate of growth for cotton increased over for the 1965-75 rate. The data therefore suggest that productivity of traditional southern crops may be lagging significantly behind productivity of traditional midwestern and plain-state crops.

To further investigate this suggestion, rate of growth in soybean yields for the five largest soybean producing states in the South--Alabama, Arkansas, Louisiana, Mississippi, and Tennessee--was calculated for the three periods. The rates were 1.2, 0.4, and 0.2 percent for 1950-65, 1965-75, and 1975-80 respectively. The rate for the last two periods was substantially below the national average. Thus, lagging rates of growth in crop yields appears to be a phenomenon of the South not just of southern crops.

This phenomenon needs further investigation, in particular a determination of the causes. Continuation of the relatively slow increase in yields may signal and/or result in the relative stagnation of southern crop agriculture compared with the rest of U.S. crop agriculture.

## COMPARISON OF THE RATIO OF U.S. TO NON-U.S. WORLD YIELDS

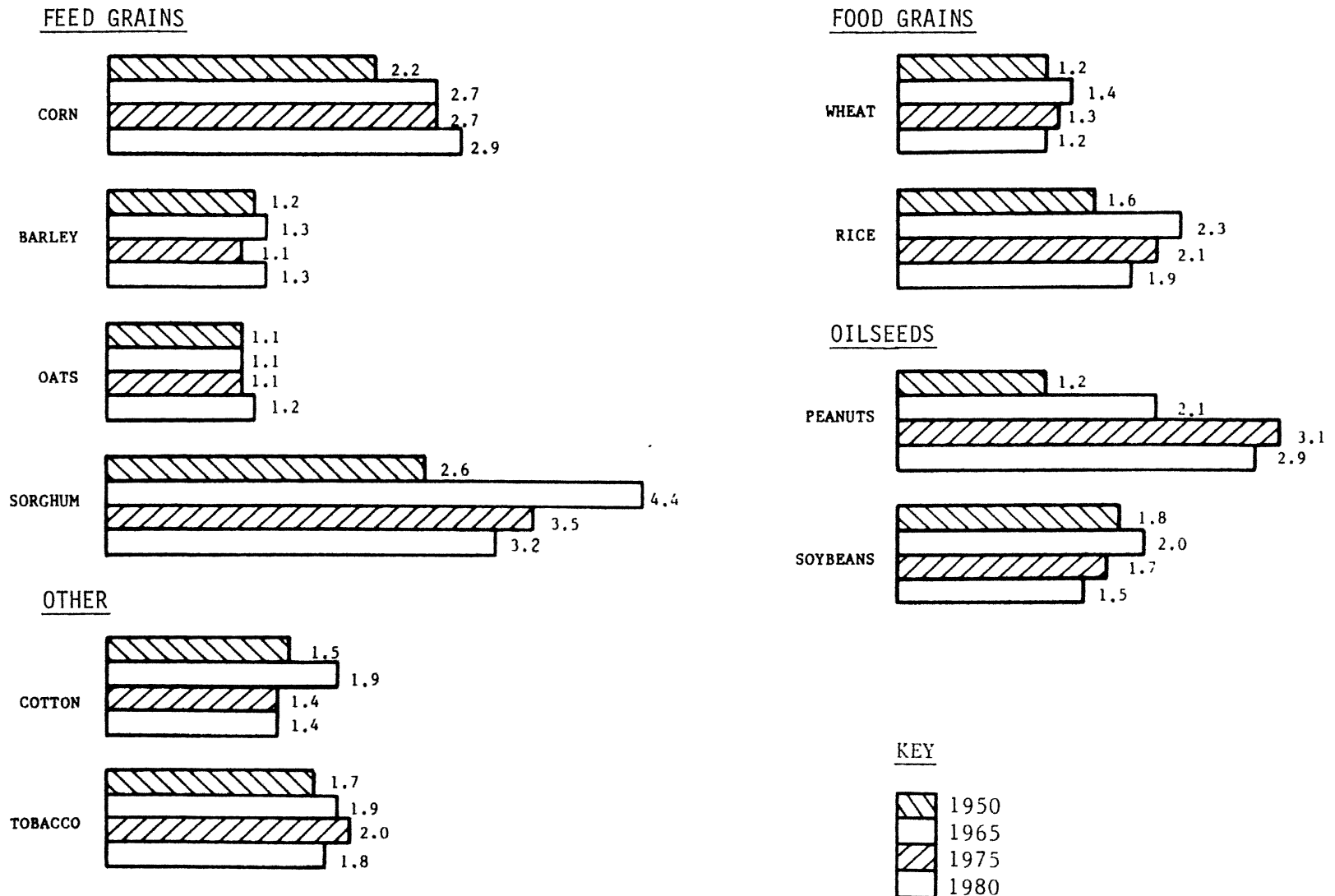
Figure 1 presents ratios of U.S. yield to the yield for the rest of the world excluding the U.S. The ratios compare five year average yields centered on 1950, 1965, 1975, and 1980.

Given its historical position as a net exporter of the ten field crops, it is not surprising that for all four years and for all ten crops, average U.S. yield exceeded average world yield excluding the U.S. However, the ratios changed substantially between the dates analyzed. For all crops except oats the ratio increased from 1950 to 1965. This change suggests that the competitive advantage of U.S. agriculture increased. However, between 1965 and 1975 the yield ratio declined for wheat, rice, barley, sorghum, soybeans, and cotton. These declines represented the intersection of a substantial decline in growth of the U.S. yield (except for soybeans) and an increased growth in the non-U.S. world yield (except for barley). The latter can be attributed in part to the so-called green revolution.

Despite the increased rate of growth in yields of U.S. wheat, sorghum, and soybeans during the late 1970s, their yield ratios continued to decline. More importantly, of the six largest U.S. field crop exports in the early 1980s only corn's yield ratio increased between 1975 and 1980. Furthermore, reflecting their sluggish rates of growth, none of the yield ratios for crops associated with the southern U.S. increased and only cotton stayed constant. Finally, by 1980 the yield ratios for five of the six largest U.S. field crops exported



Figure 1. Ratio of U.S. Yield to Non-U.S. World Yield of Major U.S. Field Crops,  
Selected Years 1948-1982<sup>a</sup>.



<sup>a</sup>Five-year average yield centered around year stated in key for U.S. divided by corresponding five-year average year for world excluding U.S.

Source: Computed from data in United Nations, *FAO Production Yearbook*, various issues; U.S. Department of Agriculture, *Agricultural Statistics: 1972 and 1983*; and U.S. Department of Agriculture, Statistical Reporting Service, "Field Crops: Final Estimates by States 1978-82, Preliminary 1983."

were less than in 1965 and for three of the four largest exported the ratios were lower than or equal to the 1950 yield ratios. Corn was the exception in both cases.

### CONCLUSIONS

Changes in the ratio between crop yields of one country and the rest of the world is at best an imprecise measure of relative changes in crop productivity let alone domestic cost of production. While acknowledging this limitation, changes in the ratio between U.S. and non-U.S. world yields suggest that, compared with the late 1960s the U.S. may have lost some of its advantage in terms of the domestic cost of production for many field crops.

This tentative conclusion along with the increasing value of the dollar further suggests that the U.S. may have lost some of its comparative advantage in the production of major U.S. field crops. A more thorough analysis of this issue is needed. Such an analysis would require a dynamic model of comparative advantage. To this end Thompson and Abbott have formulated an interesting and useful model. (8) In addition, cost of production data would need to be collected on a worldwide basis, especially for major producing, consuming, and import/export countries.

Though preliminary, the suggestion that U.S. field crop agriculture may have lost some of its advantage in terms of domestic cost of production raises questions about the potential for U.S. agriculture to "export itself" back to a 1970s style prosperity even if the dollar declines and other demand

conditions of the 1970s reappear. This analysis also suggests that the potential is particularly limited for southern agriculture given its generally stagnant crop yields since 1965. Furthermore the analysis suggests that U.S. agriculture may become increasingly dependent on corn as an export commodity. Finally, future discussions of the trade potential for U.S. field crops need to include the supply side as well as the demand side.

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